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ABSTRACT

In Hungary, the educational system is responsible for developing an up-to-date and enlightened attitude toward the environment. Elementary schools have made the greatest advance in environmental education during the past 10 years. Conditions for environmental education are most favorable in the gymnasium; secondary vocational education has the greatest lack of environmental education in its curricula. A development project for environmental education in secondary vocational training has designed an ecological and environmental protection curriculum including general and specific requirements and some elements of curriculum content. Recommendations for teacher training and postgraduate training have also been made. Three pilot programs show correlations between environmental protection and technology. They illustrate the role of the Paks nuclear power plant in environmental education, an experiment in environmental education in the Baktay Ervin Gymnasium and Vocational Secondary School for Water Management in Budapest (Hungary), and an experiment in environmental education in the Petrik Lajos Vocational Secondary School for Industrial Chemistry in Budapest. Comprehensive analysis proposals are for the modernization of Hungarian environmental education and solutions to problems arising within the framework of international collaboration. (Appendixes include 20 references and 4 tables.) (YLB)

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Environmental education and training in Hungary

by András Benedek and Agnes Kohl

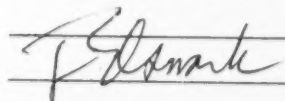
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by András Benedek and Agnes Kohl

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Introduction

This study has been prepared at the request of ILO. Its purpose is to provide a concrete analysis of environmental education in the light of Hungary's present stage of economic and technical progress. Furthermore it purports to be more of an analysis of change, research and development in environmental education since 1987 than a mere description.

The study first focusses on environmental education in the Hungarian school system. Besides an outline of projects aimed primarily at

the modernisation of vocational teaching at school, the analysis also includes case studies of correlations between environmental protection and technology.

The study ends with analytical research, including proposals for the modernisation of Hungarian environmental education and suitable ideas of how to solve the problems now arising within the framework of international collaboration.

I. Environmental education in vocational education and training

A. Preceding events and general conditions

The final decades of the 20th century are very difficult ones for mankind. One of the most crucial problems is the overall environmental crisis threatening the Earth's biosphere, and hence man's existence, too.

Only a change in people's attitudes and in their manner of life can bring about satisfactory results. The development of an up-to-date and enlightened attitude towards the environment is, first and foremost, an educational task. It follows that educational policy, and especially teaching, has an important part to play in ensuring success.

In Hungary, just as throughout the world, educational research on environmental education began in the early 1970s. But in spite of the growing difficulties, Hungary's environmental policy and educational policy have failed to recognise the tremendous importance of education in environmental protection. It is the lack of appropriate measures in educational policy that chiefly accounts for the fact that in spite of numerous good examples, in spite of excellent teaching practice in various places, the efficiency of environmental education in Hungary is still less than satisfactory in the early 90s.

People have become increasingly responsive to environment related problems. Thanks to a general social interest, the government has begun to devote much more attention to the development of environmental education and training.

For all that, it has failed to recognise the latent potentials of education in full measure in its environmental and educational policy.

Despite the adverse circumstances, successful initiatives have been taken in several research workshops as well as kindergartens and schools (building on the time-honoured tradition of Hungarians' love of nature) to develop a healthy attitude towards the environment and to work out the structure, requirements and content of environmental education and training.

In Hungary the educational system is responsible for developing an up-to-date and enlightened attitude towards the environment, since society demands that it develop appropriate habits, attitudes and the right forms of behaviour. It is obvious, however, that a certain amount of specific knowledge is also required if these educational goals are to be achieved. Teaching material on environmental education is divided into three parts:

The first part involves information on nature. It comprises essentially the plant and animal species found most frequently in the immediate surroundings to be interpreted, first, in a narrow sense and, then, at higher levels of education, in a wider sense. The second set of information, based on the first part, reveals conformities to the law of nature, i.e., basic ecological phenomena and their relationships.

The third part consists of information on environmental protection and nature conservation. By virtue of its multidisciplinary quality, this range of information is made up of scientific, sociological and technical-technological elements, none of which can be left out of consideration. (See Table 2, p. 23). Multidisciplinary superimposition of environmental education)

Although some elements or manifestation of environmental education are found in nearly all kindergartens, the teachers do not possess

the kind of sound pedagogical and ecological knowledge they need to transmit information efficiently or to fully take advantage of possible curriculum content and teaching methods.

Positive habits, along with the acquisition of knowledge, increase in elementary school. In addition to emotive prompting, conscious attitudes tend to appear increasingly. A system of habits takes root, developing into positive forms of behaviour.

The greatest advance made in environmental education during the past ten years is, perhaps, that achieved in elementary schools. As of 1978, environmental education has become an educational task - though to a varying extent in documents pertinent to education, in the curricula and text books of science subjects.

All schools have received copies of "The handbook of environmental education" (OPI, 1981), which sums up the basic content of the curriculum, educational principles and methods.

The purpose of other publications is to facilitate professional and educational work within and outside the school.¹ For example: *Environmental club and environmental camp in elementary schools* (National Institute of Education (NIE) and National Environmental Protection and Nature Conservation Office, 1981); *Excursion Guide: 1. Excursions in the Bükk Mountains* (NIE, 1982); *Small encyclopaedia on ecology*; Maria Szerényi: *Opportunities for environmental education in the teaching of Hungarian literature. An optional programme for elementary schools*, the "Principles of ecology and environmental protection" was introduced in 1983. A teachers' manual was published simultaneously with the curriculum.

The aims and tasks of environmental education in secondary schools are practically the same as those in elementary schools, except that the methods applied correspond to the age level of the students. Here, too, the development of an up-to-date and enlightened attitude towards the environment calls for:

an open outlook on the environment, which is based on concrete knowledge and can be developed further;

consciousness of one's responsibilities in one's way of life;

active behaviour based on conviction and reason.

Conditions for environmental education, are most favourable in the gymnasium (academic secondary school). The curriculum includes several subjects that provide basic information on environment and ecology. These subjects are biology, geography and, to some extent, history. It is a fact, however, that the vast majority of subjects (including chemistry, for example) still do not contain a sufficient amount of material on environmental education.

B. Environmental protection and vocational education

Secondary vocational education has the greatest lack of environmental education in its curricula. Technological education also lacks an environmental management approach. This is all the more noteworthy, because the majority of 14 year olds (about 75 %), continue their studies in secondary vocational schools once they have completed compulsory general education. Secondary vocational education in Hungary today has unduly disjointed aims, too many occupational streams and levels of training.

Differentiated specialisation has resulted in the establishment of a great number of schools functioning separately from each other. Two- and three-year training courses are limited to a narrow field of occupations, with little opportunity for students to continue their education. Four-year apprentice training, however, allows for students to take up further education, but the qualifications of skilled workers with higher professional and general education are rarely appreciated at the work place.

A new, experimental form of training in Hungary is the training of technicians. During a five-year training period, students acquire a general level of education comparable to that provided in gymnasiums and are given vocational training exceeding all previous forms of secondary education. The most attractive feature of technician training is its flexibility: following basic training for two years in a wider group of occupations (geology surveying, water management, for example), the students will, at the age of 16, decide as to which line of studies (water management, for example) or on what level (two more years of apprenticeship or three more years of technician training) they wish to continue. The decision, of course, also depends on their abilities as well as their school achievement. Following the fourth year of technician training and having passed final examinations equivalent to those taken in gymnasiums, they may continue their education at college or at university.

In view of this situation, it has become necessary to carry out thorough, analytical research in order to establish the feasibility, requirements and various forms of environmental education in the different types of vocational schools.

C. Development project for environmental education in vocational training (1987-1990)

The project was designed by the National Institute of Education (NIE) and the Ministry of Environmental Protection and Nature Conservation. It was initiated in 1987 at the premises of NIE, the forerunner of the National Institute of Vocational Education (NIVE). A research team was put in charge, and moral and financial support was provided by the Ministry of Trade and Commerce.

Taking social demands for environmental education as its point of departure, the project worked out, an initial ecological and environmental protection curriculum including general and specific requirements as well as

some elements of curriculum content for the concept of environmental education in vocational schools. As a result, the students should be able to develop an up-to-date and enlightened view of the environment.

(See Table 3, p. 25, Concept and structure for the development of environmental education in vocational schools)

The development of the concept of environmental education had been preceded by a wide-ranging and detailed analysis of the prevailing conditions. As a result, these types of schools were found to have the greatest difficulty in developing environmental education.

The intricate system of vocational education, the multiplicity of general, vocational, practical and theoretical subjects, the great number of weekly lessons, the subjects crammed with material, as well as multisectoral control are all factors which militate against the development of environmental education.

But at the same time, there is a conspicuous absence of certain science subjects, biology and/or geography in many of these schools. So there is nothing with which to link the elements of ecology or environmental education.

The basic subjects providing general and specialised education, the curricular objectives, the educational tools and methods do not as yet concentrate on environmental education or on how to increase the students' scope of knowledge. The teachers do not make suitable use of opportunities to link environmental education to the different subjects, nor are these opportunities reflected in the curricula.

It is for this reason that we have worked out our a concept in two blocks giving rudimentary principles required for environmental education.

The first block comprises general information on environmental protection based on ecology, with unified content for all school types in

secondary vocational education. This information is a sequence to the material for environmental protection provided in elementary schools, which forms part of general vocational subjects and is destined to develop correct attitudes towards the environment.

The second block consists of specific, occupationally-related information on environmental protection, arranged in specialised groups, with different content for each group.

The structural build-up of the first block necessitated the introduction of a basic subject to solve the problem of integration in conformity with the requirements of environmental education.

But steady adherence to the principle of multidisciplinary required that environmental information relevant to general and vocational preparatory subjects should also be added to the curriculum.

Specialised information on technologies protecting the environment and utilising waste materials had to be built into the second block, with different content for each group of occupations. This information is linked to specialised subjects in vocational training, including material knowledge and technology.

To develop the information into a curriculum, we had to define some principles of content and teaching.

These are:

The central role of the living creature, primarily that of the human being;

Interpretation as a systems approach of human beings as biological creatures and of the realm of nature about them;

The application of the systems approach to biological, social, economic and technical life as a whole;

The principle of interdisciplinarity of environmental education;

The principle of superimposition, namely that environmental information in secondary vocational education should be in line with the educational system's requirements and its scope of knowledge of the environment.

D. Structure and content of the new programme of environmental education

1. Man and his environment

Man and his environment is the name of the block of information which is to form the basis of environmental education in secondary vocational education. It was designed for 36 lessons (72 including practice sessions). It is recommended for Class 1 or Class 2.

The main chapters are as follows:

Ecology;

Nature conservation and environmental protection (scientific and technological approach);

Environment - health.

The premise for the concept developed in the programme is conformity of the biosphere to the laws of nature (ecology). It goes on to deal, first, with the sources of danger threatening the biosphere and, then, with the topics of environmental management and environmental protection. It also treats the economic, technical and technological feasibilities of environmental protection. In the twofold context of environment - health, and a healthy way of life and the harmful effects of civilisation - the last chapter discusses environmental protection from the point of view of human health bringing it into line with the national programme for safeguarding health.

A characteristic touch in the pedagogical elaboration of the programme is the fact that alternative choices are provided for different occupations, as well as for the most topical and central problems. Numerous supplementary materials and readings are provided in the textbook for this purpose.

Man and his environment was taught in six schools (9 classes) for experimental purposes, over a period of two years. With the help of the experience gained by teachers, the current versions of the curriculum and textbook have been worked out upon the recommendations of the Society of Technical and Scientific Associations and the Hungarian Academy of Sciences.

In 1990, Man and his environment was developed into an educational programme. The basis of the programme is the curriculum and the textbook for *Man and his environment*. Supplementary requisites are as follows:

Teachers' manual;

Selection of exercises;

Series of slides (sets, each comprising 50 slides), accompanied by 4 textbooks: Ecology, Nature Conservation, Environmental-Protection, Environment - Health.

Alternative possibilities to introduce Man and his environment into the general curriculum are as follows: In schools where the number of weekly lessons is less than 33, it could be introduced as a new, additional subject (in the 2+3 system of technical secondary schools, for example); where the number of weekly lessons is 33 (maximum allowed), it could be fitted in with the curriculum of related subjects such as biology, geography, principles of vocational skills, principles of vocational practice and - here and there - some special subjects. It will be up to the sectoral ministry or, in some cases, the school concerned to determine the extent to which the curriculum of the general subjects needs to be decreased. It could yet be taught as

an option, in study circles or in other extracurricular forms.

2. General supplements for environmental education (chemistry, physics, geography, history)

These have been designed for the curricula of history, and certain science subjects such as chemistry, physics and geography, currently used in vocational secondary schools. Only to a small degree, if at all, do they require separate lessons. They consist of environmental aspects, mainly correlations, which can be linked directly to the curriculum prescribed. No problem is involved in accommodating them. There is no supplement for biology since its curriculum includes the rudiments of ecology and environmental protection.

These supplements have been prepared as teachers' manuals.

3. Specialised principles of environmental management

In our opinion, the purpose of education for specialised environmental management is to develop in young people a conscious attitude towards the environment. Over and above giving a general outlook on environmental protection, this will enable them not only to understand the prerequisites and new environmental management at the workplace, but to carry out appropriate measures and operations as well.

Besides the general principles set out earlier, we propose the following ideas and guidelines on the development of the specialised principles of environmental management:

They should be built on the general scope of knowledge of environmental protection included in Man and his environment as well as in other science and vocational subjects;

They should conform to the information contained in the specialised subjects;

They should aim at up-to-dateness in content, and at complexity in outlook and agrotechnological solutions;

Emphasis should be put on:

the economic and ecological correlations between environmental protection tasks;

integrated clean technologies - as opposed to technologies "after the event" which reduce not only waste, but the consumption of energy and raw-materials as well;

the legal regulation of environmental protection.

The information basis should be directly applicable in everyday work.

It is most desirable that specialised information on environmental protection should be taught in different streams of education (skilled worker schools, secondary vocational schools, technical secondary schools) with a minimum of difference, since all school-leavers may potentially endanger or protect the environment in like manner - though not on the same level.

We have organised teaching material on environmental management into 21 specialised groups and correlated them to some 380 occupations. The correlation was based on the similarity of harmful effects upon the environment in the use of material and/or on the level of technology, or in some other special respect. (See Annex, p. 31, Specialised groups of environmental management in vocational secondary education)

In the field of industrial and agricultural occupations the optimum situation is if environmental management information is linked to different specialisations arranged on three levels:

Knowledge of materials as a basic level.
Here it is the environment damaging ef-

fects due to the nature of various materials that should be dealt with in the subject group on material knowledge;

Technology, technologically-linked effects on the environment should be studied in the subject group concerning different technologies;

Economics, where, almost as a synthesis of occupational skills and environment knowledge, the economic aspects of environmental management should be dealt with in any of the following subject groups: business economics, safety and environmental protection (in the fifth year), or the principles of economics.

In the area of services, special information on environmental management, linked to special subjects, should be taught.

The methodology we followed was to select 8 fields of occupation dissimilar to one another from the point of view of environmental management. In line with our uniform concept and principles, we then proceeded to work out specialised information on environmental management for each of the eight fields.

These occupational fields are as follows:

Metallurgical group (heavy pollution);

Energy industry group (heavy pollution);

Chemical industry group (heavy pollution);

Stockbreeding group (heavy pollution);

Water conservancy group (manifest effects of pollution);

Commercial and catering group (affected by pollution but with little pollution of its own);

Economic group (shapes one's outlook on the environment);

Kindergarten teachers group (shapes one's outlook on the environment).

We recommend these specialised blocks of information on environmental management to the sectoral ministries to use them, as it were, as models.

These recommendations are designed to develop a way of thinking in terms of environmental management based on the same principle. At the same time, they furnish the ministries concerned with background information on our research achievements.

E. Teacher training and post-graduate training

A key issue in the efficiency of environmental education is the training of teachers.

Obviously, in the long run it is incumbent upon the teachers, mainly technical teachers, to initiate the students into the ways and means of protecting the environment. It is therefore most desirable that they should be prepared for the task in graduate and post-graduate training. A range of information on environmental protection is now being introduced into most institutions of higher education, though on different planes and in different curricula. For all that, no coordination has yet been effected.

In the short run, we have proposed a multi-level solution. Our point of departure therefore is that all teachers should be trained to pass an up-to-date and enlightened attitude towards the environment to students. Their basic qualifications should be taken into consideration, of course.

The first step in this direction would be the training of one or two teachers (biology teachers, if possible) in each school, who will have advisory functions in the matter of environmental education in the school concerned. (See Table 4, p. 27, Proposed system of teacher training and post-graduate training)

We recommend that this training should be carried out simultaneously on several levels, in the course of about a 5-year period.

In graduate training involving all branches of teacher training;

In post-graduate training;

In refresher courses of about a 2-week duration, arranged by universities and colleges within the framework of summer school (with large attendance);

In courses organised by various Educational Centres for Environmental Protection and the Society for the Dissemination of Scientific Knowledge - with the cooperation of university and college experts;

In training organised by some national or regional institute to disseminate an educational document or programme prepared for environmental education - with the help of first-class experts.

As a model for this last form of training, we propose the course designed to teach the programme Man and his environment. Arranged by the National Institute of Education and the Ministry of Environmental Protection and Nature Conservation, this course was attended by 154 teachers in Kecskemét between 25 and 29 June 1990. In the coming years, we intend to establish this form of training as a permanent feature of further education.

Post-graduate training for teachers should be put into effect in regional centres for environmental education.

Each of these centres should be linked to a university or college:

with university or college training provided;

within the framework of the Educational Centres for Environmental Protection or the Society for the Dissemination of Scientific Knowledge.

Our proposal has met with good response on the part of the institutes of higher education and the Ministry of Environmental Protection

and Nature Conservation. In the light of this, arrangements have been made from different quarters to pursue the issue, with the NGO's

also participating in the programme besides the institutes referred to.

II. Case studies on field-work in environmental education in Hungarian vocational schools

This section deals with with three relatively unrelated pilot programmes, their purpose and their tasks. Although the examples have the same purpose, they illustrate different fields of application. Vocational instruction in nuclear energy, water management and chemical engineering clearly show the tremendous importance of environmental education.

A. The role of the Paks nuclear power plant in environmental education

This is the only Hungarian nuclear energy firm. Environmental education in the Vocational School of Energetics founded by the firm in 1986 is closely linked to its activities, which have to do with the uses and production of nuclear energy, mainly with the nuclear plant itself.

As part of their formal education in power plant engineering the students study radiation protection, fully treating the pollution of the environment not only by nuclear, but also by other types of power plants. In order for them to carry out field-work in the controlled zone of the nuclear plant, it is essential that they pass an examination in the company's rules and regulations on radiation protection. In the courses of their field-work carried out alongside regular employees, the students are given an opportunity to familiarise themselves with the plant's dosimetric laboratory. They learn to read the thermoluminescence counter of personal dosimeters in order to be able to determine the quantity of ionizing radiation absorbed by the living organ. They are introduced to the control systems which have been designed to measure the amount of radioactive materials released from the plant, i.e., the

measuring feasibilities of the control stations that have been set up within a 3 km radius of the reactor (shielded and unshielded Geiger-Müller counters are used for measuring the dose of gamma-rays emanating from the clouds; iodometric telemeters are used for measuring the temporal integral of activity concentration, the system for sampling high-volume air, fallout, adhesive bonding, grass and soil). Moreover, they become acquainted with work carried out in the environmental control laboratory, where samples collected by the stations are processed.

Within the framework of power plant engineering and nuclear plant technologies, the students learn about the normal running of an RBMK-1000 reactor of the Chernobyl type and analyze the situation of the break-down and the nuclear plant accident which was due to the reactor's inability to self-regulate itself and the operator's failure to comply with the rules of operation. The school introduces the students to the company's contingency plan in connection with the Chernobyl accident, including the increased technical, organisational and operational precautions.

As members of the Scientific Society for Energetics, some of the students and instructors attend scientific lectures on energy production. In the autumn of 1990, they attended a symposium on environmental protection, learning about the biological and genetic effects of radiation. Several students have entered a recent essay competition on environmental protection.

The school has joined the national network of acid rain measurement, organised by Lorand Eötvös University. The students collect samples of rainwater, measure their pH values and submit their results to the national net-

work. Plant employees with technical teacher's qualifications have been requested to attend a basic course at the plant. A special course on nuclear technology has been arranged for teachers specialised in the humanities, so that they can further their knowledge of the nuclear plant (and be in charge of radiation protection). A teacher with qualifications in dosimetry keeps tabs on the dose absorbed by workers and the students. As circumstances may require she/he organises special sessions for the students and conducts nuclear measurements for them.

In the college linked to the Vocational School of Energetics, lecturers from the Technical University of Budapest hold 5 classes a week on environmental protection in the first term. The programme is as follows:

Environmental protection:

The effect of energetics upon the ambient air;

The sources of air-pollutants: natural and man-made emissions; the rise of pollutants in heating (sulphur and nitrogen oxides, fly ash, etc., radioactive emissions into the atmosphere from flue-gas cleaning equipment and nuclear plants);

Factors influencing expansion and thinning: the origin and structure of wind trajectory; atmospheric stability and factors advancing stability; the effect of stability upon thinning;

Cumulative effect of chimney height: concept, determinants, empirical formulae;

Expansion and thinning models: simple Gauss models, feasibilities for correction, spread of sediments, standardised methods for calculating transmission;

Estimate of air pollution: time dependent concentrations, duration diagrams, domestic emissions and pertinent regulations; rudiments of effect appraisal in the instance of electric power and heat output. Effect of energetics upon natural waters.

Thermal pollution: source, expansion, effects;

Solid wastes of power plants;

Slag, fly ash: disposal feasibilities, area reclaim;

Radioactive waste materials: temporary storage and final disposal.

When the nuclear plant was built, an efficient system for environment control was set up. It was designed to keep tabs on the quantity of radioactive material released into the environment, to observe the meteorological parameters determining the dispersion of radioactive materials and to check on any other data pertinent to radiation protection. The sum total of these data can be put at about 3 million annually.

Given the knowledge of data on emissions, an estimate can be given on the expansion model. Computer programmes are used for calculating the quantity of radiation that affects the population living in the immediate vicinity of the nuclear plant as a result of the release of radioactive materials. With a view to extra precautionary measures, the Hungarian authorities responsible for radiation protection (and the Ministry of Environmental Protection and Area Development) operate a system of environmental control to check the data on the nuclear plant's measurements and collate them with data of their own. The authorities responsible for radiation protection set strict limits to the additional quantity of radiation that can, within reason, be permitted.

Data on emissions indicate that the health of those who live in the vicinity of the nuclear plant is in no way endangered by the small quantity of the extra dose they receive. This is because high-efficiency air-filters are used to keep the activity of atmospheric emission at a very low level.

The Department of Education and International Relations of the Paks Nuclear Power Plant is responsible for the employees' basic

training and maintaining their level of knowledge. Well-equipped class-rooms, examination rooms as well as a video studio are available for the purpose.

The general population's knowledge of the nature and operation of nuclear power plants is rather scanty and sketchy. With this end in view, the Information Bureau of the nuclear plant has arranged a forum for the discussion of questions of public concern or interest. It has issued publications and journals to promote general understanding of the matters that have given rise to much controversy. (Following the Chernobyl accident, the Civil Defence Command took the necessary precautions and supplied the population with gas-masks.)

B. An experiment in environmental education in the Baktay Ervin Gymnasium and Vocational Secondary School for Water Management, (Budapest)

A pilot project was launched in the water management branch of the school, with one group of students in each of three classes (22, 26 and 24 respectively). The first experimental class is due to complete its third year in 1991. The purpose of the experiment (1988-1993) is to train water management technicians, who will be well versed in the related tasks of environmental protection and management and who will, have a conscious attitude towards the environment entrusted to their care in their future employment.

During the entire period of training (Classes 1-5), the experimental time-table allows 2 facultative lessons a week for the study of environmental protection.

On completion of their training the students will be granted a technician's diploma in environmental protection and water management.

Vocational education in water management is a special area from the point of view of environ-

mental education. Professional skills cover the entire field of water management and water protection. Special emphasis should be put on such issues of nature conservation as are linked to the aquatic world, and, furthermore, to biology.

What is stressed in the first two years is the development of the students' attitude. This requires an approach through biology, geography and aesthetics. In Classes 3, 4 and 5, however, the students acquire a technical, technological and economic knowledge of environmental protection, which is necessarily linked to the subject of water management.

The subject studied in class is nature conservation. Its main topics are: knowledge of the species (plant and animal taxonomy), the principles of nature conservation, protected natural resources, Hungarian National Parks, nature conservation areas, wild life preservation, world heritage, "Red Book", tasks in nature conservation, interventions to maintain good conditions, survey methods, etc. As an additional feature, in the summer the students carry out various practical assignments in environmental protection. These may include a field trip to one of the National Parks or to a nature conservation area - in line with the objectives of the curriculum.

In Class 2, the students continue to develop and expand their fields of knowledge through the study of Man and his environment. Ecological exercises have been added to the course, so that the students can adapt theory to practice by studying the specific features of water management associations and factors which have a local effect. On completion of Class 2, in the summer, the students do field-work in one of the National Parks. The programme includes observation, survey, data processing, etc. This complex practice is meant to underpin their motivation in the years to follow.

In Class 3, course content is as follows: principles of safeguarding the purity of air, different methods for testing the quality of air, limit values, basic cases of technical interven-

tions, relationships between the protection of the quality of air and water management, soil protection, relationships between water management and soil protection. Mid-year exercises are carried out in the technology of measurement. To supplement their summer practice, the students are shown a reclamation programme (in Gyöngyösvisonta or Tatabánya, for example) and the array of instruments at the Institute of Meteorology.

In Class 4, the students are introduced to the subject of waste management. It is in the context of water management, of course, that they familiarise themselves with the entire field of waste management: types, quantity, quality, source, transport, treatment, disposal and recovery. Students in the branch of water management concerned with built-up areas study various technologies for treatment, storage and disposal as well. Summer practice includes, among other things, a demonstration of a dumping ground.

In Class 5, the technicians-to-be are introduced to the complex utilisation of natural resources. Through the use of concrete examples and taking account of the characteristics of the age-group and the knowledge that the students have acquired up to then, this course has been designed to help them decide in the course of each intervention (structures, operations) on the particular aspects they must consider so as not to damage the environment. At the same time in this final year they will learn to form a synthesis. This means that under the guidance of instructors, given a series of simulation problems they will be able to weigh questions involving resource utilisation and environmental management of different regions on their own initiative.

It is of major importance to school the students in the methods of refined discussions and to teach them how to appear before the public, since these skills will be essential to their work; they will help the future technicians to develop the ability to reason with possible opponents that the work they do in different regions is environment-friendly.

The success of the experiment could help to develop a correct attitude towards environmental management and protection in the water management experts. Furthermore, the experiment could serve as a model for the other ten vocational schools featuring water management.

C. An experiment in environmental education in the Petrik Lajos Vocational Secondary School for Industrial Chemistry (Budapest)

This is an on-going experiment foreseen as a model started in 1988 and to be terminated in 1993. Its objective is to develop an enlightened attitude and a sense of responsibility in the students towards the environment. It is therefore essential that they should:

- be aware of the manifold correlations between nature, human beings and the environment;

- recognise that they are to be personally responsible for the condition of the environment;

- be able to play a part in solving problems relating to the environment;

- be able to make activities prompted by economic considerations conform to ecological requirements.

It was with these considerations in view that the concept for the experiment has been developed, namely that the students should, by progressive stages, advance from general knowledge of the environment towards the special knowledge required in the chemical industries.

Theoretical knowledge is supplemented by a demonstration of practical examples. Moreover, the students participate in summer sampling with the object of acquiring on-hand experience in environmental protection and nature conservation.

The experiment was launched with one group of students in each of three classes (34, 35 and 33 respectively). The first experimental class is due to complete the third year in 1991. Throughout the five years, the experimental education takes place on the basis of one lesson a week within the framework of field practice.

In Class 1, nature conservation and environmental sanitation are taught on the basis of the programme on Man and his environment. What is stressed here is a factual presentation of the conformity of the biosphere especially the life of man - with the biological laws of nature, as well as the general process of environmental pollution.

From Class 2 through Class 5 environmental protection in the chemical industries is taught.

In Class 2, running alongside and in conjunction with field practice and inorganic chemistry, matter required to be known in connection with environmental protection in the chemical industries is taught. Special emphasis is laid on the natural and anthropogenic occurrences of different inorganic substances (cations, anions and molecules) and on the part they play in pollution. The students thoroughly study the effect that these substances have on different organisms and on the biosphere (toxic effects, allergic reactions, accumulation, etc.): in connection with some chemical substances they also explore the possibilities of protection against these impurities. They are given essential information on the safe storage of laboratory chemicals, on their uses, and on the route of toxins in the human body (access, absorption, distribution, accumulation and excretion). They obtain additional knowledge of environmental protection concerning the ions of the compounds to be made and the use of acids and alkalis. In the second term of Class 2, they learn about matters involving environmental protection in the context of the chemicals used in quality analysis, as well as of the ions to be demonstrated in close connection with the cation and anion classes of the qualitative analysis of chemistry. Utmost care is given to the proper treatment and the neutralisation

of laboratory waste-materials containing acid, alkali, heavy-metal ion and organic solvent.

In technical vocational schools, the theoretical part of the training begins in Class 3. In the vocational school for industrial chemistry, Class 3 has the following subjects:

- Industrial chemistry (2 lessons a week);
- Chemical operations (4 lessons a week);
- Physics and chemistry (2 lessons a week);
- Organic chemistry (2 lessons a week);
- Field practice (9 lessons a week).

To supplement this vocational training, the students continue to study environmental protection in the chemical industries. Within the scope of this subject, they are introduced to environmental problems arising in industrial chemistry and in manufacturing processes, and they learn the possibilities, both in theory and in practice, to cope with them. The major topics studied are as follows:

- principles of the reduction of chemical emissions;
- problems of environmental protection in connection with the industrial use of water;
- industries and technologies which are perilous from the point of view of air pollution;
- air pollution caused by vehicles;
- environmental protection in energy production:
- procedures aimed at reducing the emission of sulphur dioxide in the chemical industries;
- procedures aimed at reducing the emission of nitrogen oxides in the chemical industries;
- procedures aimed at reducing the emission of ammonia in the chemical industries.

At the end of Class 3, the students take part in alternative summer practice in environmental protection in order to supplement the theoretical training they have received in the first three years. The concept for the practice (named Analytical tests for environmental protection - analysis of drinking water) has been worked out. The required standards, chemicals and tools will soon be acquired and the writing of the curriculum and the experimental textbook is now in progress.

In Class 4, the students continue their study of environment-friendly technologies. It is of special importance that they be conversant with these technologies and with the advantages of different alternatives in:

- the desulphurisation of flue gas;
- the domestic manufacture of environment-friendly alkylates;
- the electrolysis of alkalichloride with a membrane cell;
- the reduction of the emission of hydrogen fluoride.

Other subject-matters of importance are:

- manufacture and use of fertilizers from the point of view of environmental protection;
- manufacture and use of pesticides from the point of view of environmental protection.

Also at the end of Class 4 the students are scheduled to take part in alternative summer practice in environmental protection. The concept for the programme is being worked out at present.

In Class 5, the subjects dealt with are as follows:

- problems relating to the environment in the manufacture of plastics (PVC, for example);
- problems relating to the environment in the manufacture of pharmaceuticals

(neutralisation of organic solutions, for example):

methods of industrial sewage purification.

The questions at a qualifying examination for technicians must include those concerned with environmental protection.

Besides the version described above, an alternative training programme for environmental protection is being worked on at present. It is envisaged that it will qualify the student as "Industrial technician in environmental protection".

What will take place in the initial four years will essentially be technician training in the chemical industries, reinforced with ecological and biochemical knowledge. In the final year, the qualification will build upon the base as a chemical technician with an environmental protection attitude. Thus in Class 5, the curriculum will include theoretical and practical subjects of environmental protection, in about 10-12 lessons a week. Included among the planned theoretical subjects will be water treatment and sewage purification, safeguarding the purity of the air in the industry, management and handling of hazardous waste, as well as biotechnology in environmental protection. Instrumental measuring will be practised in about 16 lessons a week.

The training will end with the student taking a technician's qualifying examination.

It is in conjunction with personality development that the student should establish a sense of responsibility for the environment. Training should equally impress "on the mind, on the heart and on the hand".

In so far as the experiment turns out to be a success, environmental protection in the chemical industries could be included in the curriculum of the other vocational secondary schools for industrial chemistry.

By this means, environmental awareness and activity in the profession will hopefully reach a higher standard.

4. Comprehensive analysis proposals

What we have achieved so far can be regarded as the initial attempts and partial results of a long-term process of development.

On the whole, we have managed to compile a curriculum of general information on the environment at a satisfactory level. In the future, however, it will be necessary that the curriculum for Man and his environment be modified. Part of it is undoubtedly matter that should be taught in primary schools and, as such, should be included in the national curriculum. This part should then be replaced by a complex science subject, focussed on global problems. One topic would deal with environmental protection, discussed in terms of natural science, economy, law and technology. The other topic would be concerned with matters relating to biology, with man as the focal point. It would be designed to make man's biological nature conform to the effects of civilisation, to a healthy way of life and to sociological relationships.

As to the development of a specialised knowledge of environmental education, however, only the initial steps have been taken, with large blank areas to be explored yet. The development of information on environmental protection and management in terms of specialised vocational groups is no more than an inchoate solution - due to our scanty resources. Our recent examinations of the subject show that there is an urgent need to construct a systematic framework for specialised knowledge of environmental protection and to keep different specialisations apart.

According to our hypothesis, the problems should be approached from the point of view of economic activities and not from the angle of school branches (or occupations). Specialised knowledge of environmental protection

should be worked out in relation to environment-friendly materials and technologies.

An alternative solution could be, for example, a computerised processing of environment-friendly materials and technologies, so as to develop an information system from which the schools can choose the particular environment-friendly methods that suit their subjects. Our plans include the development of such a storehouse of information.

It has been ascertained that the proportion of theory and practice in environmental education is inappropriate. Though the role of practical training has been recognised in principle, not enough time has been allowed for it within the framework of the curriculum. We have to pay more attention to the seemingly novel methodological solutions - far from typical of vocational education - such as situation games, artistic approaches, dialogues, thinking in terms of alternatives, simulation exercises, case studies. More care should be taken in developing methodological culture.

The effect of the emotions to motivate people should not be left out of consideration in the case of secondary school students either. Unfortunately, we do not fully take advantage of this possibility in regard to this age-group. Indeed, we only conjure up for them the spectre of an environmental catastrophe, which, from time to time, elicits a feeling of total nihilism on the part of the students. The problem is not so much the fact of revealing a real danger to them; it is much rather the fact that environmental catastrophe is presented as the sole possibility, with no alternatives of any kind. What we should do is lay the true facts before them: show them the possible alternatives which they can influence themselves through their personal contribution - if they use an environment-friendly detergent or pesticide, for example, instead of one that causes damage to the environment.

This is, perhaps, where we find the greatest difficulty in regard to environmental education. Although the students have a clear conception of problems relating to environmental

protection, they have no sense of personal responsibility towards their immediate surroundings; in consequence, they feel unable to cope with events. It is our view that the raising of local problems and the students' involvement in trying to solve them could help more effectively to awaken them to a sense of responsibility. Urgent steps are required in this regard.

We are hindered in our efforts mainly by factors of a deep rooted attitude, over and above the prevailing economic conditions. It is due to this that environmental education in Hungary is still on the fringe of the entire field of formal school education.

It is but on rare occasions that vocational schools come forward with concrete demands aimed at some particular idea. If they do, these ideas only come to light in individual experiments. Our task in this connection is to give the schools meaningful support and to help coordinate their activities.

Several steps are required to bring social demands into harmony with environmental education. First, workshops should be set up in institutions and schools, where research teams would work out the requirements and the information blocks to be built on these requirements. Next, these information blocks should undergo a testing period of about two years in experimental education; simultaneously they should be referred to professional organisations, university and college experts to report on. Finally, they should be corrected on the strength of school experience and expert opinions, and proposed for introduction into the curricula.

One problem for environmental education is the fact that as yet there is no demand for environmental experts. It is only now and then that institutions and firms require experts with

environmental know-how. This situation can likewise be put down to an ossified attitude. Urgent steps are required in this regard.

Nor can we talk in earnest about requests for environmental education programmes, due partly to our socio economic situation and partly to the above-mentioned attitude.

The number of unemployed youth is still fairly low, so we have failed to make any provision for their environmental training.

In the Hungary of today, the key issue of the development of environmental education and training - as we have already mentioned - is the training and post-graduate training of teachers, particularly technical teachers, in environmental protection. This task falls within the autonomy of institutions of higher education. It is also very important, however, to coordinate this training, which is the responsibility of the Ministry of Culture and Education.

In these days it seems more and more necessary that the upper echelons - political leaders, managers, principals and experts should be trained in issues concerning the environment. The Ministry of Environment and Area Development and the Institute of Environment Management have already worked out a detailed programme for this type of training on three levels. At present, however, a number of factors such as attitude, economy etc. render things difficult and hence delay the launching of this training programme.

Summing up the present situation, we may say with good reason that there are manifold initiatives in Hungarian environmental education, both in the area of teacher training and in regard to the elaboration of the requirements for environmental education. The development of environmental education has been fostered and is accelerating.

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Table 1

The Hungarian education system

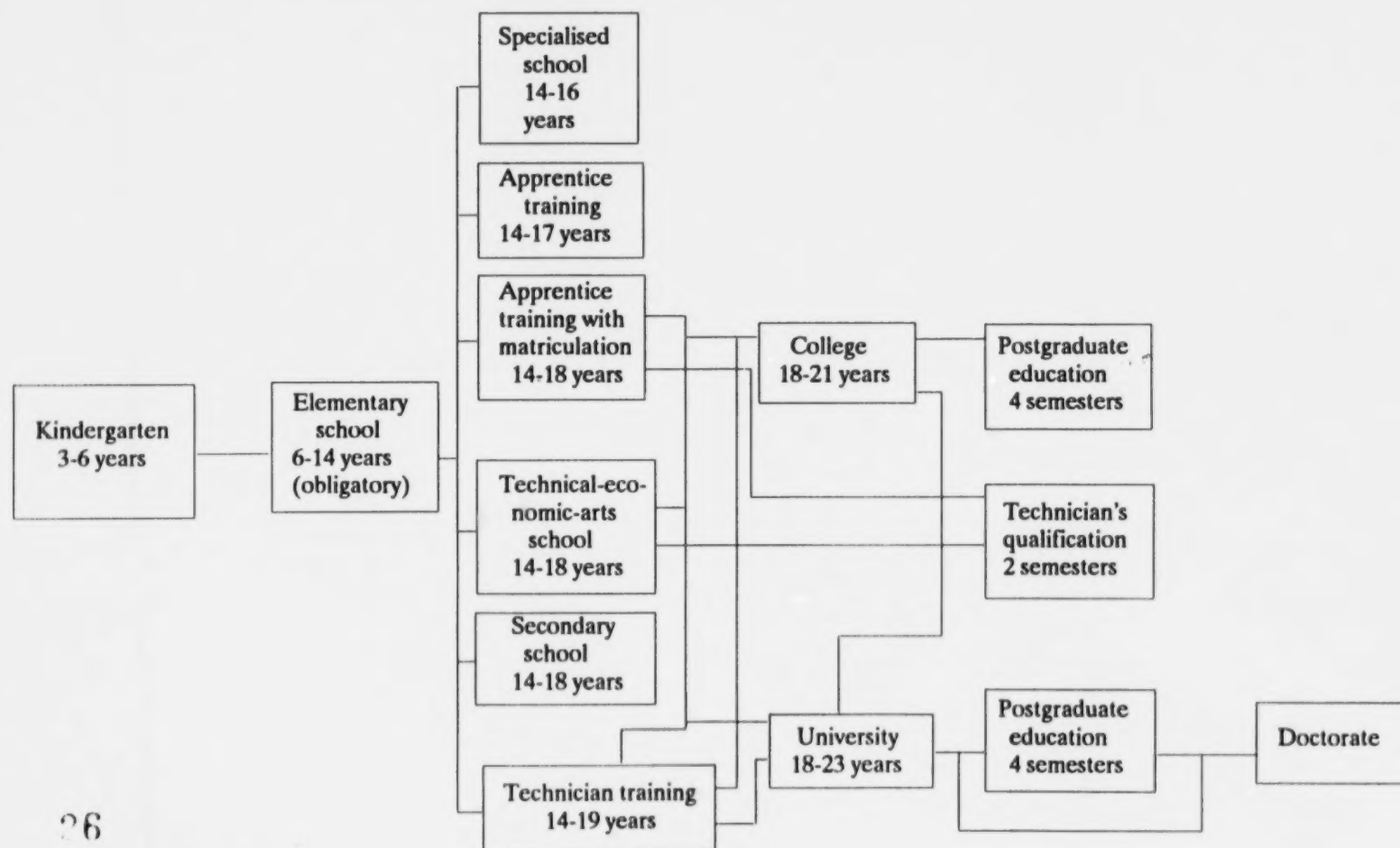


Table 2

Multidisciplinary superimposition of environmental education

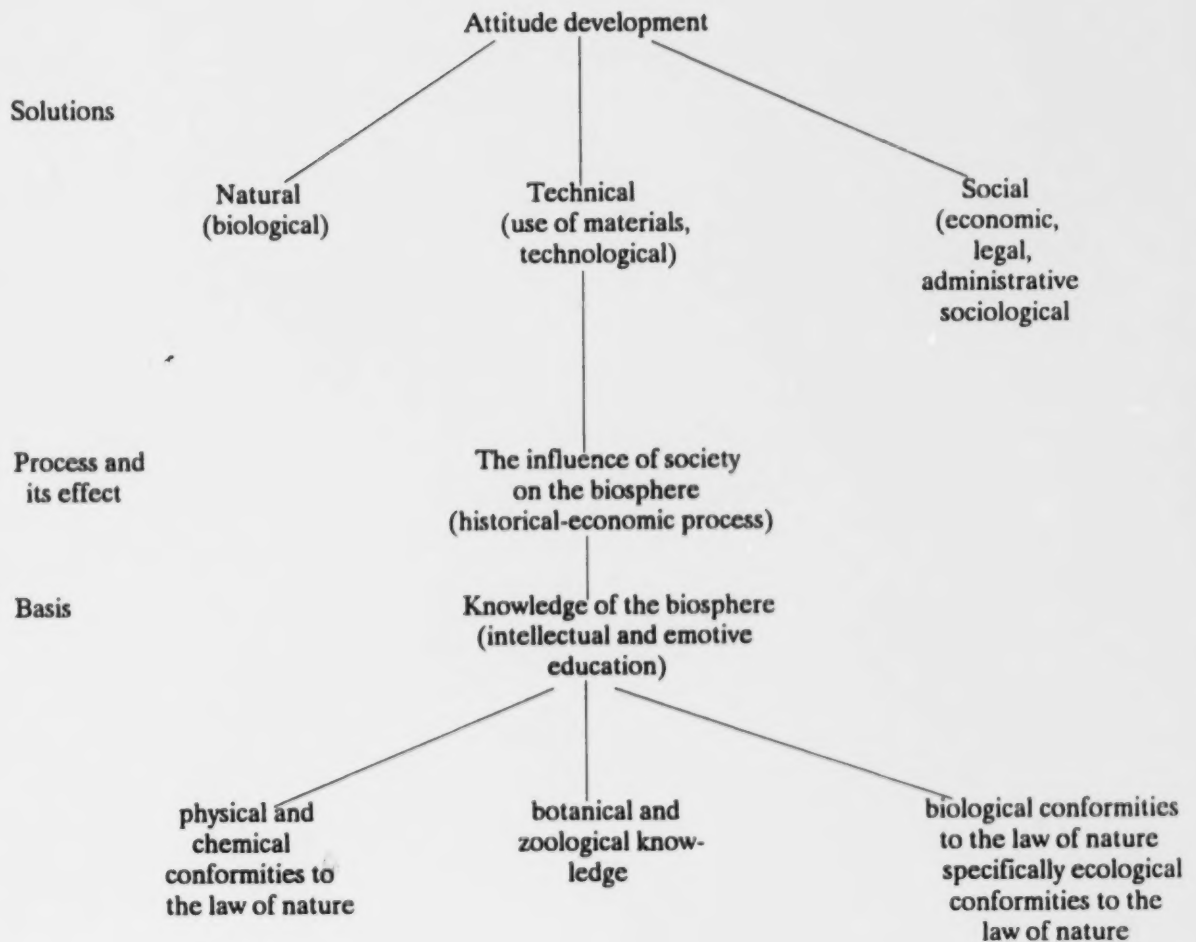


Table 3

Concept and structure for the development of environmental education in vocational schools

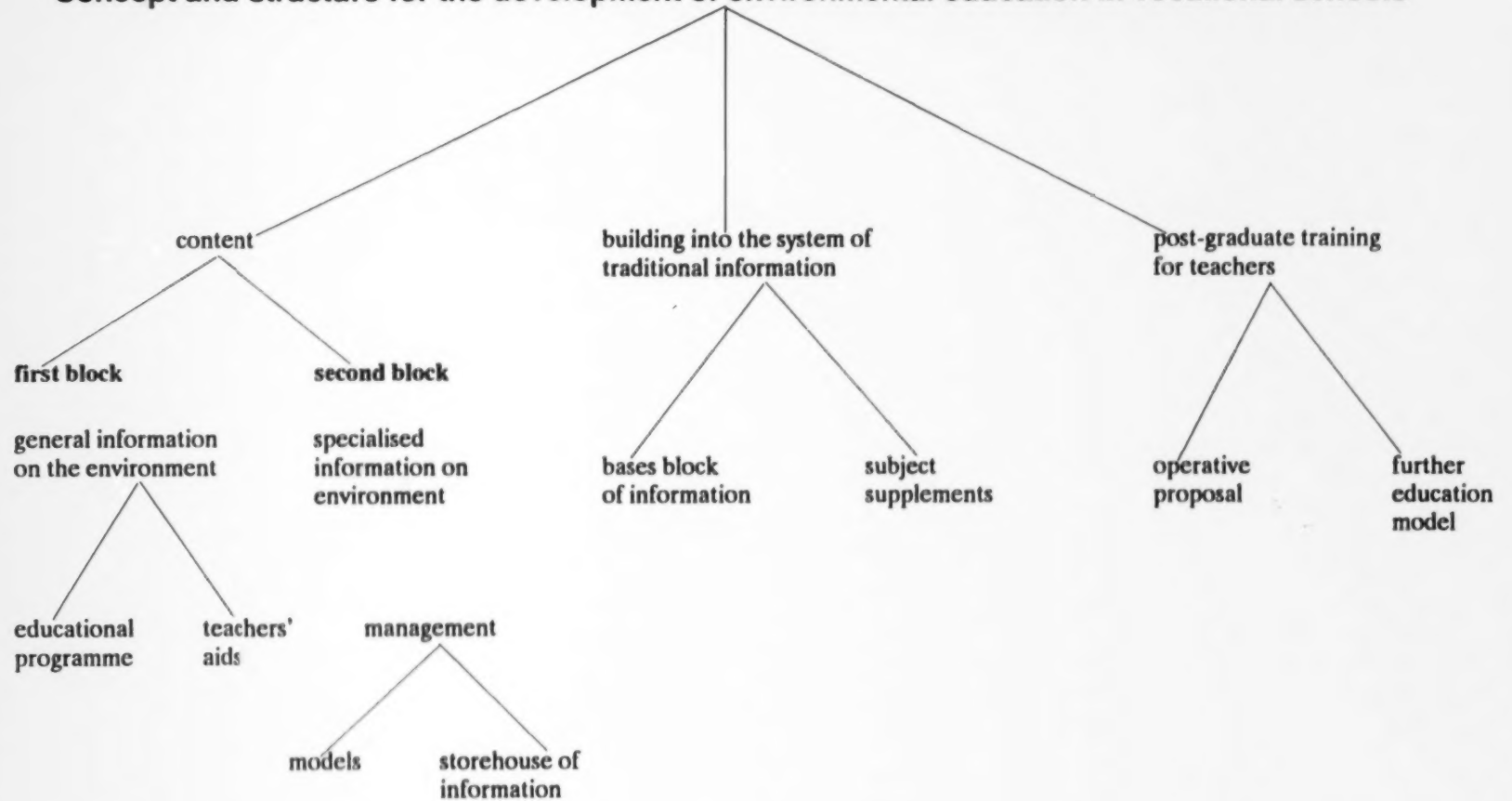


Table 4

System proposed for teacher training and post-graduate training



**Specialised groups of environmental management
in vocational secondary education**

1. Mining;
2. Metallurgy;
3. Nuclear power plant;
4. Metal working and engineering industry;
5. Electrical industry;
6. Building-material, pottery and glassmaking;
7. Building industry;
8. Forestry and woodworking industry;
9. Chemical industry;
10. Paper and printing industry;
11. Textile and clothing industry;
12. Leather, fur and shoemaking industry;
13. Economy, organisation and planning;
14. Water management;
15. Plant cultivation and horticulture;
16. Stockbreeding and veterinary hygiene;
17. Food and catering industry;
18. Commerce;
19. Transport and traffic;
20. Public health;
21. Kindergarten teachers, arts.